

Duvall (A)

COMMUNICATION

IN RELATION TO A

Supply of Water

TO THE

CITY OF BALTIMORE,

BY ALFRED DUVALL.

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1854.

TO THE HONORABLE

THE FIRST AND SECOND BRANCHES

OF THE CITY COUNCIL:

GENTLEMEN:

HAVING been solicited by a number of respectable citizens, (several of whom are members of your Honorable Body,) to present for your consideration, plans, whereby the City of Baltimore can have, without too heavy an outlay, an immediate increased supply of water, I respectfully submit my views relative to the subject matter.

I presume it is known to all, or most of your Honorable Body, that I presented to the late Council, a communication relative to an abundant supply of water to the City of Baltimore, (from the Falls of the Great Gunpowder River by *natural flow*,) defining a general plan for such purpose, based on preliminary examinations, surveys, &c. I had made at my individual cost.

From an examination of my communication referred to and of the late Report of T. E. Sickels, Esq. upon a supply of water for the City of Baltimore, it will be seen, the general plan recommended by Mr. Sickels, is substantially what had before been *originated* and *recommended* by myself, though Mr. Sickels' views as to the point for the location of a dam in the Gunpowder River, and termination of *line* of proposed Tunnel—with some plans of arrangement in minutia, differ somewhat from what will be found recommended in my communication (referred to,) and from what are still my views relative to the matter—but my views relative to an immediate increased supply of water to this City, differ very materially

from what I believe are those of Mr. Sickels, or any other party in regard to this important subject.

I should have named in my communication to the late Council, more in detail, a plan for an immediate increased supply of water, but my object at that time was but to call attention to what I felt satisfied was the true source and general plan, whereby the City of Baltimore could procure a cheap and abundant supply of WATER for all time to come. And I am still of the opinion, that the general plan recommended in my former communication, with but slight modifications, is the best that can be adopted, as I believe I shall be able to demonstrate, particularly, if looking to an immediate increased supply without too great an outlay.

What I shall herein propose, may be considered as supplementary to my former communication relative to a supply of water to this City.

PLAN

For giving to the City of Baltimore an immediate additional supply of five million gallons of water per day, in dryest seasons—and from an elevation of 175 feet above mean *high tide*.

First, what I propose is, that the City of Baltimore can and should look to the Herring Run for an immediate increased supply of water, which by the means of reservoirs, (viz: one in the valley of Herring Run, near Mr. Gauthrop's Mill, and one in that of Mr. Tiffany's Valley, above the Hillen Road, an immediate increased supply of water can be secured from an elevation of 175 feet above mean high tide, and to an extent of at least five millions of gallons per day, in dryest seasons, *as will be demonstrated*, and at a reasonable cost, and the expenditure for procuring the same will be for a permanent work, and as far as made, be perfect, for a large additional supply from the Gunpowder River by natural flow.

This (the Gunpowder River) is the true source, in my opinion, that should be looked to for an abundant supply, but

the Herring Run, by storing its waters, can be relied on safely to furnish five millions of gallons per day, and for comparatively a small cost; and the works necessary for furnishing such supply can be completed within twelve months or less, and for a sum that I beleive will come within the available means of the City, (as will be hereinafter shown) without imposing an additional tax for such improvements.

ELEVATIONS.

From levels taken by myself, (which have been tested by the parties under Mr. Sickels, and found correct,) the elevation of water in the pool of Mr. Gauthrop's dam is 181. 43 feet above mean high tide.

RESERVOIRS.

By the erection of a dam in the Herring Run, at a point some 1000 feet below Gauthrop's Mill, or rather upon the site of the dam appertaining to the next mill below, of sufficient height to raise or retain the water in same at an elevation of some 185 feet above tide, a good reservoir would be formed of an area of at least thirty to thirty-five acres and principally in the immediate valley of the stream and of very considerable depth, and most of it surrounded by high banks requiring but little excavating so as to give a depth of water of 15 feet in shallowest parts of same. Most of the line surrounding the proposed reservoir would require no walling or lining as the surrounding ground rises abruptly and is principally of a rocky formation.

RESERVOIR IN THE VALLEY OF TIFFANY'S RUN.

By the Construction of a dam or embankment across the valley of Tiffany's Run, as proposed in my communication to the late Councils, or as recommended in the report of Mr. Sickels by raising an embankment on the bed of the Hillen Road, would flood, at an elevation of 168 feet above tide as

per Mr. Sickels' report, an area of some thirty-seven and one half acres, and with but slight excavations, give a reservoir of a depth of 15 feet in shallowest parts.

I propose the dam or embankment shall be raised sufficient to give an elevation for the surface of the water in the reservoir of some 175 feet above tide—such elevation being some 7 feet higher than that proposed by Mr. Sickels, and from the formation of the valley proposed to be flooded, I feel satisfied an area of some 50 to 55 acres will be flooded, and so as to give a depth of 15 feet in shallowest parts of the same without requiring extensive excavations.

An elevation of 175 feet above tide will give water to nearly all the improved parts of the City.

CAPACITY OF RESERVOIRS.

I assume the reservoir, that may be formed in the valley of Herring Run by the erection of a dam at the point named, will flood an area of at least thirty-two acres, that may be reckoned to have a perpendicular depth of 15 feet in shallowest parts.

The reservoir that may be formed in Tiffany's Valley, by damming or embanking as named, will give, I assume, with but slight excavations, an area of at least fifty acres, that may be reckoned to have a perpendicular depth of 15 feet in shallowest parts of same.

Assuming the areas and depths for reservoirs as named, viz. thirty-two acres in the valley of Herring Run, and fifty acres in the valley of Tiffany's Run, allowing for a perpendicular depth of 14 feet (to the named areas,) that may be drawn off for supply, we have, adding the areas (32+50) of the two reservoirs, eighty-two acres area, or 3,571,920 superficial feet, which with the depth named, give a supplying capacity of 50,006,880 cubic feet, or 374,077,440 wine gals. of 231 cubic inches to the gallon. Dividing 374,077,440 by 74, we find that the reservoirs, when filled, will furnish

5,055,100.54 gallons per day, as proposed for seventy-four days, allowing the flow of Herring Run in dryest seasons to be no more than sufficient to supply the loss from absorption, leakage and evaporation from the proposed reservoirs.

But I believe I shall be able to show, that throughout the late unprecedented drought, the flow of Herring Run at Gauthrop's Mill, was much more than sufficient to supply the loss from evaporation, &c. Moreover, the never failing affluent that flows through the valley of the proposed distributing reservoir, may be counted on as an item in the supply, as well as the percolations into the tunnel, that will be required through the dividing ridge between the valley of Tiffany's Run and that of the Homestead.

FLOW OR CAPACITY OF HERRING RUN.

The late unprecedented drought reduced the waters of Herring Run to a very small flow; but the flow did not cease at any time at Gauthrop's Mill, and from information received from several respectable parties, and from the *amount* of grinding done by the Mills on the stream, the flow of same throughout the late drought, may be safely reckoned at 600,000 wine gallons per day at Gauthrop's Mill.

From information received from Mr. Gauthrop, the amount of grinding done at his Mill throughout the late drought, was on an average about seven barrels of flour per day. Showing the stream at that point, independent of leakage from dam and raceway, must have furnished to his Mill, some 600,000 gallons of water daily (*throughout the drought.*) As it requires about ten horse transmitted power to manufacture fifty barrels of flour in twenty-four hours, (as will be shown by a letter of the Messrs. Denmead, addressed to me, and published in Appendix E of Mr. Sickels' late Report,) taking the ratio of 7 to 50, we find it will require 1.4288

transmitted horse power to manufacture seven barrels of flour in twenty-four hours.

But as the capacity of Mr. Gauthrop's Mill is such as to be capable of making from sixty to eighty bbls. in twenty-four hours,—and the friction of the machinery to be overcome from having to run the hoisting, cleaning, bolting apparatus, &c. for making seven barrels of flour per day, being as much or nearly so, as if the amount manufactured were fifty to sixty barrels, it may be safely assumed, that it requires at least from 2 to $2\frac{1}{4}$ transmitted horse power to manufacture seven barrels of flour when running the necessary cleaning, &c. machinery of a Mill capable of making seventy barrels.

The Wheel driving Gauthrop's Mill, is an overshoot of 23 feet diameter.

600,000 gallons of water per day of twenty-four hours, falling on such wheel, being equal to $416\frac{2}{3}$ gallons per minute, allowing 8.3388822 pounds to the gallon, would give 3474.53 pounds per minute, falling through a line of descent of 23 ft. which by established formula, is equal to about two transmitted horse power. Thus showing that it requires a flow of at least 600,000 gallons of water per day, falling on a wheel of 23 feet diameter, to manufacture seven barrels flour.

EVAPORATION.

When looking to a supply of water by storage, Evaporation must be taken into consideration. From referring to the results of various experiments relative to Evaporation, I find that something less than one-sixth of an inch (depth) per day (in summer) is the largest amount set down as being evaporated from exposed and elevated situations in latitudes differing but little from that of Baltimore.

It may be therefore assumed that an allowance of one-sixth of an inch per day to be evaporated in the dryest seasons from the surfaces of the reservoirs proposed, will be full and sufficient. The extreme areas flooded by the reservoirs,

allowing for slope of embankments, will be some 88 acres equal to 3,833,280 superficial feet. Now one-sixth of an inch, (which we will allow for daily evaporation) is equal to 53240 cubic feet, or 398,262.90 wine gallons, (of 231 cubic inches to the gallon.) Hence we find that the evaporation, from the proposed reservoirs, will, in the most extraordinary droughts, fall short of the flow of Herring Run, as assumed for the same throughout the late drought, by some 201,738 gallons per day.

ABSORPTION AND LEAKAGE.

In the first filling of a canal or reservoir, absorption or the saturation of the earth, in the line of works, is a matter of some consideration; but after such works are filled, in a short time the loss from this cause becomes nominal. Leakage from canals or reservoirs, depends on their construction; and when such works are properly constructed, (as those proposed can be and with facility) it is a matter of small amount, and with absorption, hardly need be taken into account; however, as some small loss at all times must occur from such causes it may be considered; but the supply of water furnished by the never-failing affluent, flowing through the valley proposed for the distributing reservoir, will be much more than sufficient, (as I believe all who have a knowledge of the same will admit) to supply any loss from absorption and leakage, and I doubt not, in addition to these, be sufficient to supply the loss from evaporation of 50 to 55 acres of flooded surface.

GENERAL PLAN OF PROPOSED WORKS.

As has been named, I propose a reservoir in the valley of Herring Run, and one in Tiffany's valley. To avoid a present heavy outlay for works on Herring Run, I recommend that a cheap, but good dam, principally of wood well filled in, shall be erected on the site of the dam, appertaining

to the first Mill below Gauthrop's. I recommend a cheap dam in the Herring Run, on account of economy of first cost, but *principally*, that the cost of that part of the works for conducting a present supply from Herring Run, to the distributing reservoir in the valley of Tiffany's Run, may be small—so that, if hereafter an air line tunnel from the Gunpowder to the Tiffany reservoir should be thought more desirable, than an air line tunnel from the river named to a terminus in the valley of Herring Run, near Col. Hillen's, the present expenditure on works, from the Herring Run may be of small cost.

By the proposed dam in Herring Run being built of wood, it can be easily reduced in height to correspond with the level desired, so as to receive the water of the Gunpowder by natural flow through tunnel.

To conduct the waters of the Gunpowder by natural flow through an air line tunnel, into the valley of Herring Run, will be found recommended in my former communication relative to a supply of water to this City.

Such plan, I still believe to be the best and most economical; letting the tunnel from the Gunpowder have its terminus in the valley of Herring Run, something lower down than I before recommended, say at a point in the valley, about south-east from the dwelling of Col. S. Hillen, and the line of work from that point a conduit for a short distance, and the cut refilled, and thence an open cut of some 100 or 200 yards, connecting with the proposed lake in Herring Run, and by which, the line of works to be made is extended considerably nearer the distributing reservoir in the valley of Tiffany's Run.

From a point on the west side of the lake near the overfall of same, (for a permanent work,) I recommend an air line to the Tiffany reservoir, (distance about 3,500 feet,) by tunnel and cut with conduit and cut refilled.

By the formation of the lake in the valley of Herring Run, (by the lines I propose for works from the Gunpowder, as

will be shown by the map of Mr. Chiffelle's survey) the line of works or excavations to be made from the Gunpowder to the Tiffany reservoir is shorter by some 2,000 feet, (not counting the lake in Herring Run) than an air line tunnel between the same points, and the entire distance, including the Herring Run lake, from the Gunpowder to Tiffany's Run by the lines indicated by me, is but a few hundred feet longer than an air line, and in my opinion, a cheaper and better line, or at least as good, for I cannot see any objection to a reservoir or lake in the valley of Herring Run; more particularly if the flow of the Gunpowder is turned into it; especially with the reservoir capacity, that will be availed of in the valley of Tiffany's Run, as by a proper arrangement of same, a supply of *clear* water can at all times be had for domestic use.

As it may be thought best for the future supply from the Gunpowder to be conducted by an air line route direct to the Tiffany reservoir, (though I would not recommend such route,) and looking to present economy of outlay, I recommend a canal or raceway for conducting the waters of the Herring Run to the distributing reservoir in Tiffany's valley.

A raceway for the purpose named will not be expensive or difficult of construction, commencing at a point in the lake near the overfall of the lake-dam on the right bank of the Herring Run, and running from thence with the high ground along the stream to and around a point of high land making down near to what was formerly called Hall's upper mill, and from thence crossing or connecting with a small ravine making down from near Mr. Stirling's and north of Mr. Richard's. The ravine being narrow can be crossed by a cheap wooden aqueduct, though I recommend damming the same by embanking, as it would not be expensive and would create a small pond or reservoir of some two or three acres—moreover through this ravine flows a small but unfailing stream which would add to some extent to the supply. From the south-

west side of the ravine named, the raceway would be constructed around the course of the high ground along the north or left bank of Tiffany's run, and south of the dwelling of Mr. Richards, to the distributing reservoir. The entire distance (by line) of works proposed, is not over 4500 feet, and I am confident, (having lately examined the route) it is by no means a difficult or expensive one.

The level of the lake in Herring Run being some 10 feet higher than the Tiffany lake, a canal or raceway of small transverse area for water-way will be sufficient to pass a large amount of water ; but I propose the area for water-way in the raceway shall be sufficient for the passage of from one and a half to two millions gallons per day ; so that every advantage of a rise of the waters in Herring Run may be availed of for filling the Tiffany valley reservoir, as well as the lake in Herring Run.

The reservoir in the valley of Tiffany's Run, I propose to be constructed as per plans recommended in my former communication relative to the same, or per plans as recommended by Mr. Sickels, raising, of course, the dam or embankments *higher* and having more extensive excavations according to increased area. For the line of works through the dividing ridge between the valley of Tiffany's Run and Homestead valley, I recommend it should pass through the same, near the dwelling of Mr. Tiffany, by cut and tunnel, and terminate by conduit in the valley of Homestead, near what is known as Patterson's place on the north of the valley and within some 2500 feet of the city limits.

*Estimate of the probable cost of the Works proposed
for securing Five Millions gallons of Water per
day, (from an elevation of 175 feet,) delivered at
the City limits.*

Cleaning and excavating reservoir in the valley of Herring Run, including such walling or lining as may be neces- sary,	\$12,000	
Dam in Herring Run, including fram- ing and inlet gates of wood to raceway,	15,000	
Raceway from the Herring Run lake to the distributing reservoir, including the damming of the ravine crossed by the raceway; also, the excavations necessary for a small reservoir in the ravine named,	11,000	\$38,000
Clearing, excavating, damming, wall- ing or lining the distributing reservoir, including division, embankment in same, fence, &c. as per general plan of Mr. Sickels; but allowing for increased excavations and embankments, as per increased area flooded, and increased elevation and cube of embankments, .	\$175,000	
Effluent gate house and gate fixtures, gate and bearing frames for same, of cast iron, and if deemed necessary, rub- bing faces lined with composition, .	7,500	
Drain pipes, valves, filtering cham- ber, &c.	10,500	\$193,000
Amount,		\$231,000

Amount brought forward, \$231,000

Line of works from reservoir to near what was formerly known as Patterson's place, (on the north side of the Homestead valley, and within about 2,500 feet of the City limits,) by tunnel through the highest part of dividing ridge, and on either side, a conduit and cut refilled; the capacity of tranverse area of the conduit, to correspond to the size, and of the character recommended by Mr. Sickels;—entire distance from reservoir to point named near Patterson's place, about 5,000 feet, \$100,000

Temporary gate house, chamber and gate at terminus of conduit, and proposed place of future pumping a supply to a higher elevation, when the water from the Gunpowder may be introduced, 5,000

(The distance from terminus of conduit, to connect with the present water mains at or near the City pumphouse, is about 7,000 feet.)

About 2,500 feet of 36 inch main, to City limits, at \$15 per foot, 37,500

142,500

373,500

Add ten per cent. 37,350

\$ 410,850

Amount brought forward,	\$410,850
Damages for water rights on the Herring Run,	\$50,000
Land for reservoirs in the valley of Herring Run, about thirty-five acres,	5,000
Damages for raceway and land in ravine, proposed to be dammed, . . .	1,500
	<hr/> 56,500
Land for distributing reservoir, fifty- five acres, at \$300 per acre,	16,500
Land damages, from reservoir to ter- minus of conduit,	1,500
	<hr/> 18,000
Total,	<hr/> <hr/> \$ 485,350

From the estimates, it will be seen the cost for the construction of Works from the Herring Run to that of Tiffany's, is but \$38,000; and should it be thought best for future supply, to turn the waters of the Gunpowder into the Herring Run, (which I recommend,) but little of the present proposed outlay on works from the Herring Run, can be considered as lost from a permanent work. Should the waters of the Gunpowder be turned into the valley of the Herring Run, I would advise the dispensing with an open cut from that stream to the distributing reservoir, and recommend an air line by tunnel, and conduit and cut refilled.

But should it be thought best to construct an air line work from the Gunpowder to the Tiffany reservoir, the cost for the works that would be abandoned, will be but \$38,000; and it is presumed the cost of the dam in Herring Run would not be an entire loss, as its great storing capacity would give it some value as a Mill site. The amount that may be paid for damages for water rights on the Herring Run, for present supply in case an air line route, direct from the Gunpowder to the Tiffany reservoir should be adopted, cannot be counted, or at least much of it, against the present proposed expenditure.

For it is self-evident to every intelligent mind, a tunnel from the Gunpowder through laminated rock, and underlying the source, and course of many of the springs and affluents of Herring Run, will draw off by percolation a portion of the most constant supply of said stream, and hence damages, in my opinion, will, in any event, have to be paid for the waters of the Herring Run, if a natural flow is taken from the Gunpowder. And should the air line tunnel from the Gunpowder to Tiffany's reservoir be adopted, and it be found that the flow at the Herring Run is not materially diminished by the same, the City can then dispose of the water rights on said stream, for something in the neighborhood of cost, say at 50 per cent. and there is no doubt something will have to be paid for damages on the Herring Run, even if an air-line tunnel is adopted direct to the Tiffany reservoir; and the amount for damages will, I have no doubt, be very nearly equal to the purchase of the entire water rights. *Indeed*, such is the sentiments of those owners of water rights on said stream, that I have conferred with on the subject; for, say they, if we lose any material part of our supply in dry weather, the balance is but of little value. Hence under any circumstances, by adopting the plans I propose for a present supply—but very little will be expended that will not be for a permanent work; and as shown, the entire cost is comparatively small, considering the supply, and that the expenditure, as far as made, provides for, and cheapens the cost of a future abundant supply.

Of the ability of the City to construct the works, proposed without imposing a direct tax for such purpose.

From representations made (if correct,) of the value of the unproductive property lately purchased of the Baltimore Water Company, if disposed of, the proceeds of the same would probably be sufficient to meet the expenditure for the proposed works, or, if the revenue from the water works

lately purchased, proves to be such as anticipated, the surplus revenue from same will pay the interest on some two hundred thousand dollars—Thus with unproductive surplus property, pertaining to the present water works, valued I believe at some \$400,000 to \$600,000, and a surplus revenue from water, as claimed, that will pay the interest on \$200,000 there seem to be sufficient available means for carrying out the proposed work, and that too, without imposing an additional tax for the same—and which would be the means of increasing the revenue from water rents, by the introduction of the proposed additional supply; and, by hypothecating the revenue from same, for the payment of the interest on stock issued for extending the works for an abundant supply from the Gunpowder River, by natural flow, such enterprise would be promoted.

In making up the estimates for the proposed works, *I may say*, they are of course, not from any actual survey, but are based, in part, on the late survey and estimates of Mr. Sickels, and from the former preliminary surveys made by myself, and a late careful re-examination of the line of works proposed. Still I feel confident the estimates are full for a complete work as described. And so well satisfied am I that the works proposed can be constructed in a most complete and efficient manner for the sum named, that I should be pleased to contract for their perfect completion in twelve months as per estimates.

But no work of the kind should or would probably be offered for contract without correct surveys, plans, specifications and estimates of cost.

If your Honorable Body should authorize correct surveys, plans, &c. for the proposed works, which would involve but a small expenditure, I have no doubt but the result will show the estimates of cost something less than I have named—and that responsible contractors, citizens of Baltimore, may be found who will enter into contract for the construction of proposed works in an approved manner for the estimate made, from actual surveys, and give the most satisfactory security for the faithful fulfilment of contract.

Objections to the City of Baltimore looking to Jones' Falls for any material increased supply of Water.

Jones' Falls can be made to furnish a very considerable supply of water, probably sufficient for a population of two to three hundred thousand, for domestic use only, by means of reservoirs of sufficient storing capacity—but such reservoirs are *decidedly objectionable and dangerous, or any large reservoirs when the drain from them falls to the valley of the city*, as there is always a possibility of a reservoir-embankment or dam *giving way*, let its construction be ever so perfect. I admit, however, where such works are constructed with care and without regard to cost, the probability of giving way is very small. But heavy expenditures for such purposes and security are not necessary where reservoirs can be cheaply and well constructed, and the drains from which would *not fall to the valley of the city*, as is the case with those I propose: moreover, even those giving way would not be likely to endanger life or property to any considerable extent—but the result would be very different from the giving way of a large reservoir, the drain of which fell to the valley of the City. There are many citizens of Baltimore, particularly in the lower parts of the City, who have not forgotten the *destruction of life and property* caused by the flood of 1837, and the *giving way of mill-dams* on Jones' Falls and its tributaries.

Should reservoirs be constructed on Jones' Falls of large capacity and at an elevation (say two hundred and twenty-five feet above tide) sufficient to give a supply of water by natural flow, such works would be equally or very nearly as expensive, if built with a view to security—say for a supply of 15,000,000 gallons per day—as would be the works for introducing the *entire flow of the Gunpowder River*.

And if any system be looked to for an increased supply by pumping within the City, in times of increased flow, and storing the waters within or near the City, the cost for such works would render the measure decidedly objectionable; and

particularly where such expenditures could not be made with a view to a future *abundant supply*.

That *all* or *very nearly all* of the water furnished by Jones' Falls, throughout the late drought *was appropriated* for domestic use, but few I believe will *deny*. Hence the impracticability of any further material supply, in dry weather, from said stream, except by storage: moreover, the drawing the entire supply from the channel of same flowing through the City must be prejudicial to the healthfulness of the City, particularly along the course of the channel of the Falls.

The general plans which I have recommended for an immediate supply of water from Herring Run, and a future supply from the Gunpowder, are, in my opinion, the best the City of Baltimore can adopt. As to such general plan I make further reference, to explain more fully my views relative to same, &c. &c.

It will be seen I recommend that the elevation of the water in the distributing reservoirs should be seven feet higher than recommended by Mr. Sickels. I do so for the purpose of obtaining larger storage capacity, a consideration of importance in a distributing reservoir, even where the supply is derived from the most abundant source, and particularly when it has to be conducted from a distant river.

That the reservoir referred to may be filled to an elevation of one hundred and seventy-five feet above tide, by natural flow from the Gunpowder, allowing for fall in line of works, will be shown by reference to Mr. Sickels' late Report, page 34—but should it be thought best to have the water in the reservoir named raised no higher than one hundred and sixty-eight feet above tide, with an area of thirty-seven and a half acres flooded, the cost for same would be less than as per estimates, and show a storage capacity as $37\frac{1}{2}$ to 50 or as $69\frac{1}{2}$ to 82, by counting the Herring Run lake.

There is much speculation, and objections are made by some relative to a high dam on the Gunpowder, also ob-

jections, as I have been informed (to the site located by Mr. Sickles,) by influential persons owning the same.

A high dam, particular on such a river as the Gunpowder, to be made secure, will be expensive.

A sudden heavy rising in a river and breaking up of the ice that would be formed on a large lake which would be forced down en masse, and most likely lodged or piled on the overfall of any dam, particularly, where the same is narrow. The breaking up of ice from a large lake, by the sudden rise of a river, like the Gunpowder—would to a considerable extent render almost any dam liable to accident, especially if it be a high one, unless the foundation be undoubted, back-filling very extensive, overfall wide, abutments high, and the workmanship good throughout.

On account of the objections (referred to) to a dam in the Gunpowder, at the point recommended by Mr. Sickles, I would suggest a point in the river, for a site for a dam, at or near what is known as Oppossum Hollow, a point where on the right bank of the river, rises high and abruptly a natural rock abutment, and where the hill on the left side of the river rises high but not so abruptly as on the right, yet sufficiently so as not to require an expensive abutment—after allowing for a waterway or overfall of some 250 or 300 feet which I consider as narrow an overfall as is desirable for a dam on the Gunpowder—by which a lake of large area is flooded—for under such circumstances the overfall of a dam on the Gunpowder should be wide to prevent the lodging or piling of ice to any considerable extent on the same, whereby the free passage of the water would be obstructed and cause the same to rise in the lakes.

At the point indicated for a dam, I believe will be found across the entire bed or channel of the river a solid rock formation and at very shallow depth below the surface of the river. The site referred to for a dam, is at or near the head of the first considerable rapids below the valley that I believe is called Hampton or Dulaney's Bottom. At the site named

a high dam would not be required to give an elevation of 182 feet above tide, which would be sufficient to allow for fall for the flow of an abundant supply of water to the Tiffany reservoir—so as to give an elevation for the water in the same of 175 feet above tide, without having to construct a tunnel or line of works of very large transverse area.

The site named for a dam is what I supposed when I wrote my former communication relative to a supply of water to the City of Baltimore, was called Raven's Rock, which I have since ascertained is some three-eighths to one-half mile lower down the river,—and where the surface of the flow of the same must be some eight or ten feet lower in elevation than the site I recommended.

The high point I refer to is a high rocky promontory near the head of the rapids named, and on the right bank of the ravine of Opposum Hollow.

I have often been to this site during past years and always considered it a good site on which to erect a good and cheap dam. From near the overfall of the proposed dam at the point named, for a supply of water from the Gunpowder, I would recommend an air line tunnel to the valley of the Herring Run, having its terminus some few hundred yards above the overfall of Gauthrop's dam, and thence to the Tiffany Valley by works as hereinbefore described.

The length of tunnel from the Gunpowder to the Herring Run Valley, to terminate as named, would be about 32,700 feet, as will be seen by reference to the map of Captain Chiffelle's or of Mr. Sickels' Survey. And by the plans proposed the entire line of works to be made from the Gunpowder to the Tiffany Reservoir—not counting the Herring Run lake—is about 38,600 feet, as will be seen also, by reference to the maps named, and but about 2,300 feet longer than the air line tunnel proposed direct to Tiffany's Run from the proposed high dam near Minebank Run.

Any one reading my former communication, relative to a supply of water to this city, and the *present*, will see my general

views, plans, &c. relative to the matter are substantially the same as heretofore—viz: *That the Gunpowder River is the true source to which the City of Baltimore should look for an abundant supply of water, and that by Natural Flow from an elevation of some 180 feet above tide.*

As will be seen, I do not recommend the plan I have suggested for supply from the Herring Run as an advocate of storing water for supply;—it is proposed merely to meet present wants which the interest of a large part of the city requires, and as it will be for a permanent work, and preparatory to an abundant supply from the Gunpowder, and such as the city (in its present financial condition) has the ability to carry out—believing as I do, that it would be difficult, in the present deranged financial state of the country, for the city of Baltimore to undertake, unless at great sacrifice, any heavy expenditure that would not yield an immediate revenue.

The storing of water in reservoirs for supply, though not the most desirable, where the same can be had otherwise, is nevertheless resorted to for the supply of many of the large cities in Europe, and where the supply to reservoirs in dry seasons is equal to the evaporation, and the embankments inclosing same are steep and free from decomposing matter, I believe a reasonably pure supply can be depended on.

If the state of finances of the City of Baltimore would justify it, I should most strenuously advocate the introduction of the earliest possible abundant supply from the Gunpowder, believing, as I do, that if the entire waters of that stream were introduced into our city, it would all be availed of in a short period of time for valuable purposes, and yield a large revenue on the cost of introduction—be of great interest and value to our city and pay a larger revenue, both direct and indirect, than any rail road entering it. And in such opinion I believe I am not alone.

Very respectfully,

ALFRED DUVALL, *Practical Engineer.*

